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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/555,729

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Shuming Nie

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23460

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10/29/2008

LEYDIG VOIT & MAYER, LTD
TWO PRUDENTIAL PLAZA, SUITE 4900
180 NORTH STETSON AVENUE
CHICAGO, IL 60601-6731

EXAMINER

LUM, LEON YUN BON

ART UNIT

PAPER NUMBER

1641

MAIL DATE

DELIVERY MODE

10/29/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/555,729

Applicant(s)

NIE ET AL.

Examiner

Leon Y. Lum

Art Unit

1641

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 September 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 198-223 is/are pending in the application.
- 4a) Of the above claim(s) 216 and 217 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 198-215 and 218-223 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 07 November 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 5/18/06
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of Group I, claims 198-215 in the reply filed on September 2, 2008 is acknowledged. The traversal is on the ground that the Bruchez reference does not teach "an alloy concentration gradient." See page 3 of the Response. This is not found persuasive because Group II does not recite an alloy concentration gradient. Indeed, claims 217 and 218 are not directed to a concentration gradient of any type. Accordingly, this feature is not a common technical feature between Groups I and II and Applicants' assertion that Bruchez lacks an alloy concentration gradient is immaterial. As set forth in the Restriction Requirement, since Bruchez teaches the common technical features linking Groups I and II, these features are not considered special technical features over the prior art. Consequently, unity of invention between Groups I and II is lacking.

The restriction requirement is still deemed proper and is therefore made FINAL.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 198-201, 203, 218 and 220 are rejected under 35 U.S.C. 102(e) as being anticipated by Lee *et al.* (US 6,710,366) ("Lee").

Lee teaches a quantum dot with a continuous graded alloy of distinct core and shell materials in an "interface region" between the core and shell. See column 7, lines 17-36. In this embodiment, the center of the quantum dot is purely core material and the outer surface of the quantum dot is purely shell material, with a continuous transition of the materials in the interface region, in which the transition is an alloy of the core and shell materials. *Id.* The core and shell materials can each comprise Group IV, Group II-VI or Group IV-VI semiconductor materials, including CdSe and CdTe. See column 13, lines 18-31 and lines 40-51.

Regarding claim 199, Lee teaches that the yield of the quantum dot can be between 35% and 95%. See column 42, lines 14-17.

Regarding claim 201, Lee teaches that the interface region can comprise an alloy of the core and shell materials, which can each be either CdSe or CdTe, as described above. Accordingly, Lee's teaching includes the embodiment in which the alloy is a combination of CdSe and CdTe, i.e., CdSeTe.

Regarding claim 203, Lee teaches that the core and shell materials can be CdSe or CdTe. See column 13, lines 23 and 44.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 202 and 205 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee, cited above, in view of Weiss *et al.* (US 6,207,392) ("Weiss").

Lee is described above, but does not provide the specific ratios of semiconductor materials claimed, or that the quantum dot is encapsulated in a polymer bead.

However, it is well known to one of ordinary skill in the art to optimize the specific ratios of the cited semiconductor alloy, for e.g. CdSeTe, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 f.2d 272 (CCPA 1980). Here, the general conditions of the claim are taught in the prior, i.e., the claimed alloy is described by Lee. See rejection *supra* in reference to claim 201. Weiss teaches that altering the concentration of an alloy in a nanocrystal can affect the emission

wavelength of the alloyed semiconductor nanocrystal. See column 8, line 50 to column 9, line 11. Weiss, therefore, indicates that the alloy concentration is a result-effective variable that can be optimized, in accordance with *Boesch*. Accordingly, since the claimed alloy is known in the prior art and can be adjusted, it would only involve routine skill in the art for the skilled artisan to optimize Lee's semiconductor alloy to arrive at the claimed ratios.

Moreover, Applicants have admitted that the claimed subject matter is prior art. See Specification, page 10, paragraph 0044 reciting "[s]uch semiconductors are known in the art, including for instance, $\text{CdS}_{1-x}\text{Se}_x$...wherein x is any fraction between 0 and 1." This type of admission can be relied upon in an obviousness rejection. *Riverwood Int'l Corp. v. R.A. Jones & Co.*, 324 F.3d 1346, 1354 (Fed. Cir. 2003); see also MPEP 2129. Accordingly, by Applicants' admission, the instant claim is obvious.

Regarding claim 205, Weiss teaches that the semiconductor nanocrystal can be placed in a polymer sphere. See column 13, line 51.

6. Claims 204, 206-215, 221 and 223 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee, cited above, in view of Weiss, cited above.

Lee also teaches a population of monodispersed quantum dots with a deviation of less than 5% root-mean-square. See column 8, lines 32-35.

Lee, however, does not teach that the quantum dot is conjugated to a biological agent and does not teach that the gradients vary amongst the population of quantum dots.

Weiss teaches that the emission wavelength of an alloyed semiconductor nanocrystal can be tailored by adjusting the concentration of the alloys. See column 8, line 50 to column 9, line 11. Adjusting the alloy concentration in this manner can benefit applications that require a set of nanoparticles having different emission wavelengths, but a uniform size. *Id.* Weiss

teaches that one such application is where steric restrictions prevent the presence of different particle sizes. *Id.* Weiss also teaches that an advantage of having a set of nanoparticles with different emission wavelengths is the ability to perform a multiplex assay, in which different nanocrystals are bound to different affinity molecules to detect multiple biological substances. See column 9, lines 14-35 and column 12, lines 7-44.

Given the teachings above, it would have been obvious to one of ordinary skill in the art to modify Lee's population of monodispersed quantum dots by adjusting the alloy concentrations to provide different gradients between quantum dots, as taught by Weiss. The skilled artisan would have been motivated to perform this modification based on Weiss's teaching that doing so would allow one to perform a multiplex assay to simultaneously detect different biological substances. Moreover, Lee and Weiss disclose the same type of semiconductor quantum dots (see Weiss, column 7, lines 36-50). Accordingly, the skilled artisan would have had a reasonable expectation of success in applying Weiss's teachings to Lee's quantum dots.

Regarding claim 207, Lee teaches that the yield of the quantum dot can be between 35% and 95%. See column 42, lines 14-17.

Regarding claim 208, Lee teaches that the core and shell materials can comprise Group IV, Group II-VI or Group IV-VI semiconductor materials. See column 13, lines 18-31 and lines 40-51.

Regarding claim 209, Lee does not provide the specific ratios of semiconductor materials claimed. However, it is well known to one of ordinary skill in the art to optimize the specific ratios of the cited semiconductor alloy, for e.g. CdSeTe, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 f.2d 272 (CCPA 1980). Here, the general conditions of the claim are taught in

the prior, i.e., the claimed alloy is described by Lee. See rejection *supra* in reference to claim 201. Weiss teaches that altering the concentration of an alloy in a nanocrystal can affect the emission wavelength of the alloyed semiconductor nanocrystal. See column 8, line 50 to column 9, line 11. Weiss, therefore, indicates that the alloy concentration is a result-effective variable that can be optimized, in accordance with *Boesch*. Accordingly, since the claimed alloy is known in the prior art and can be adjusted, it would only involve routine skill in the art for the skilled artisan to optimize Lee's semiconductor alloy to arrive at the claimed ratios.

Moreover, Applicants have admitted that the claimed subject matter is prior art. See Specification, page 10, paragraph 0044 reciting "[s]uch semiconductors are known in the art, including for instance, $\text{CdS}_{1-x}\text{Se}_x$...wherein x is any fraction between 0 and 1." This type of admission can be relied upon in an obviousness rejection. *Riverwood Int'l Corp. v. R.A. Jones & Co.*, 324 F.3d 1346, 1354 (Fed. Cir. 2003); see also MPEP 2129. Accordingly, by Applicants' admission, the instant claim is obvious.

Regarding claim 213, Weiss teaches that the nanocrystal can be embedded in a polymer sphere. See column 13, line 51.

Regarding claims 214 and 215, Weiss teaches a method of detecting an analyte by contacting a sample with a plurality of semiconductor quantum dots and detecting emitted light from the quantum dots. See column 13, lines 23-40.

7. Claim 219 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lee, cited above, in view of Korgel *et al.* (US 6,846,565) "Korgel").

Lee is described above, but does not teach that the alloyed quantum dot is in a light emitting diode.

Korgel teaches semiconductor nanoparticles that are capable of being implemented in light emitting diodes. See column 1, lines 37-47 and column 2, lines 44-59.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Lee's quantum dots by placing them in a light emitting device. The skilled artisan would have a reason for performing this modification since Lee teaches that the quantum dots are applicable in any optical-electrical device (see column 1, lines 31-33) and an LED is one type of optical-electrical device. Moreover, Korgel teaches that applicable nanoparticles include those having the same semiconductor materials as Lee's quantum dots. See column 1, lines 45-47. Accordingly, the skilled artisan would have a reasonable expectation of success in placing Lee's quantum dots in an LED.

8. Claim 222 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lee in view of Weiss, both cited above, and further in view of Korgel *et al.* (US 6,846,565) "Korgel").

Lee and Weiss are described above, but do not teach that the alloyed quantum dot is in a light emitting diode.

Korgel teaches semiconductor nanoparticles that are capable of being implemented in light emitting diodes. See column 1, lines 37-47 and column 2, lines 44-59.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Lee's and Weiss's quantum dots by placing them in a light emitting device. The skilled artisan would have a reason for performing this modification since Lee teaches that the quantum dots are applicable in any optical-electrical device (see column 1, lines 31-33) and an LED is one type of optical-electrical device. Moreover, the skilled artisan would recognize that an LED is a suitable device for displaying the results of Weiss's assay. Accordingly, it would have been obvious to incorporate the quantum dots in an LED device. Furthermore, Korgel

teaches that applicable nanoparticles include those having the same semiconductor materials as Lee's quantum dots. See column 1, lines 45-47. Accordingly, the skilled artisan would have a reasonable expectation of success in placing Lee's and Weiss's quantum dots in Korgel's LED.

Conclusion

9. No claims are allowed.
10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Leon Y. Lum whose telephone number is (571) 272-2872. The examiner can normally be reached on Monday to Friday (8:30 am to 5:00 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark L. Shibuya can be reached on (571) 272-0806. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Leon Y. Lum/
Examiner, Art Unit 1641

/Mark L. Shibuya/
Supervisory Patent Examiner, Art Unit 1641